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# ACTON
# Growth Management Study

OCTOBER 1986

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# ACTON GROWTH MANAGEMENT STUDY

October 1986

Metropolitan Area Planning Council

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# Executive Summary

In recent years, Acton, along with other communities in the Minuteman region, has experienced substantial development. Since 1970 the population has grown by 18 percent, from 14,770 to 17,431 in 1985. Route 2A itself has been the scene of a large amount of new construction. Condominiums have been built at Nagog Park, Davis Road, and Harvard Court. The Great Road Shopping Center and a number of smaller retail developments have contributed to the commercial character of the road.

Route 2A in Acton, coincident with Route 119, runs southeast to northwest from Concord to Littleton, east of the town center. (See Figure 1.) It is a two lane, two way roadway, approximately thirty-two feet wide. Outside of small business centers in South Acton, West Acton, and Kelly Corner, Route 2A is the site of most of the town's commercial development.

The traffic along Route 2A is predominantly local in nature, with a high proportion of commuter traffic on weekdays (shown by an uneven directional split during AM and PM peaks), and a large amount of retail traffic on Saturdays. Over the nine years from 1975 to 1984, the average daily traffic grew approximately 1 percent per year in this area. All left turns onto Route 2A are a problem at this point (level of service "E").

The traffic problems along the Route 2A corridor will be compounded by the future growth of the corridor. Full development would result in a many-fold increase in traffic volumes along the highway. Projects "in the pipeline" right now have the potential to increase traffic along Route 2A by more than 50 percent over present levels.

It is recommended that the town set up a system of project review which will establish responsibility for traffic generation. Access plans should be incorporated into site plans for the purpose of review.

An access plan would generally include three elements: traffic impact analysis, access design, and a traffic mitigation program. A traffic impact analysis basically describes the impact a development will have on roadway capacity. The access design element details how a proposed project will interact with the surrounding road network. The traffic mitigation program describes what the developer will do to reduce or minimize site related traffic.

# INTRODUCTION

In recent years Acton, along with the other communities in the Minuteman region, has grown. Since 1970 the population has grown by 18%, from 14,770 to 17,431 in 1985. Route 2A itself has been the scene of a large amount of new construction. Condominiums were built at Nagog Park, Davis Road, and Harvard Court. The Great Road Shopping Center and a number of smaller retail developments have contributed to the commercial character of the road.*

At present Route 2A is not as congested as some other segments in the region, such as Route 9 in Natick and Framingham. But, there is a common perception that the road is busy, causing delay and inconvenience. Numerous driveway entrances cause turning movement conflicts from one end of town to the other. With the planned construction of numerous residential, commercial, and office buildings along and near Route 2A, traffic problems may become severe. Given the permissiveness of zoning in the area, the potential exists for much more serious traffic conditions in the future, unless growth management and traffic mitigation measures are applied.

This report will briefly assess the potential for development in the Route 2A corridor, and discuss zoning and other land use planning techniques which might be used to influence growth in the future. Techniques will be examined which will help the town deal with existing and prospective problems in a more immediate way: low-cost traffic engineering measures, paratransit programs and methods of securing the cooperation and participation of the corridor's developers and occupants in mitigating traffic.

* See "Land Use Change 1971-80," a map prepared by MAPC and others for Acton in 1984.

# EXISTING CONDITIONS

## Physical Description of the Road

Route 2A in Acton, coincident with Route 119, runs southeast to northwest from Concord to Littleton, east of the town center. (See Figure 1.) It is a two lane, two way roadway, approximately thirty-two feet wide. This well maintained, major suburban arterial roadway has gravel shoulders, many curb-cuts, and very few signals or sidewalks. The main intersection of Routes 2A and 27 features traffic signals, and a pair of channelization islands. The southern stretch of Route 2A between Wetherbee Street and Azalea Court is straight, flat, and allows passing in both directions. This area also has paved shoulders of two to three feet, a sidewalk on the north side in front of Burger King, and a speed limit of 35-45 miles per hour.

## Land Use in the Corridor

Outside of small business centers in South Acton, West Acton, and Kelly Corner, Route 2A is the site of most of the town's commercial development. The zoning is almost entirely "general business," except for two small areas reserved for industrial use. The route is lined mainly with ground floor commercial or service oriented uses, office buildings, some apartment complexes, and an occasional single family home. The primary constraining factors on land use along Route 2A are the Nagog and Nashoba Brooks and the Penn Central Railroad running along the east side, and the wetlands on the west.

## Traffic

The traffic along Route 2A is predominantly local in nature, with a high degree of commuter traffic on weekdays (shown by an uneven directional split during AM and PM peaks), and a large amount of retail traffic on Saturdays. A substantial portion of the commuter traffic is picked up from the Acton/Littleton area, and from the employment centers along Route 2 and Route 128. There is also some outbound commuting as businesses expands along 1-495.

Average daily traffic volumes and peak hour traffic volumes along Routes 2A are displayed in Figures 2 and 3 respectively. Because both a fairly old traffic count and a fairly recent one are available for the average daily traffic east of Route 27, it is possible to calculate a traffic growth rate: Over the nine years from 1975 to 1984, the average daily traffic grew approximately 1% per year in this area.

Table 1 shows the level of service for various locations along Route 2A, as estimated by a variety of studies by others (see appendix). The most serious problem appears to be left turns onto Route 2A from any intersection streets. All left turns onto Route 2A are designated level of Service "E".

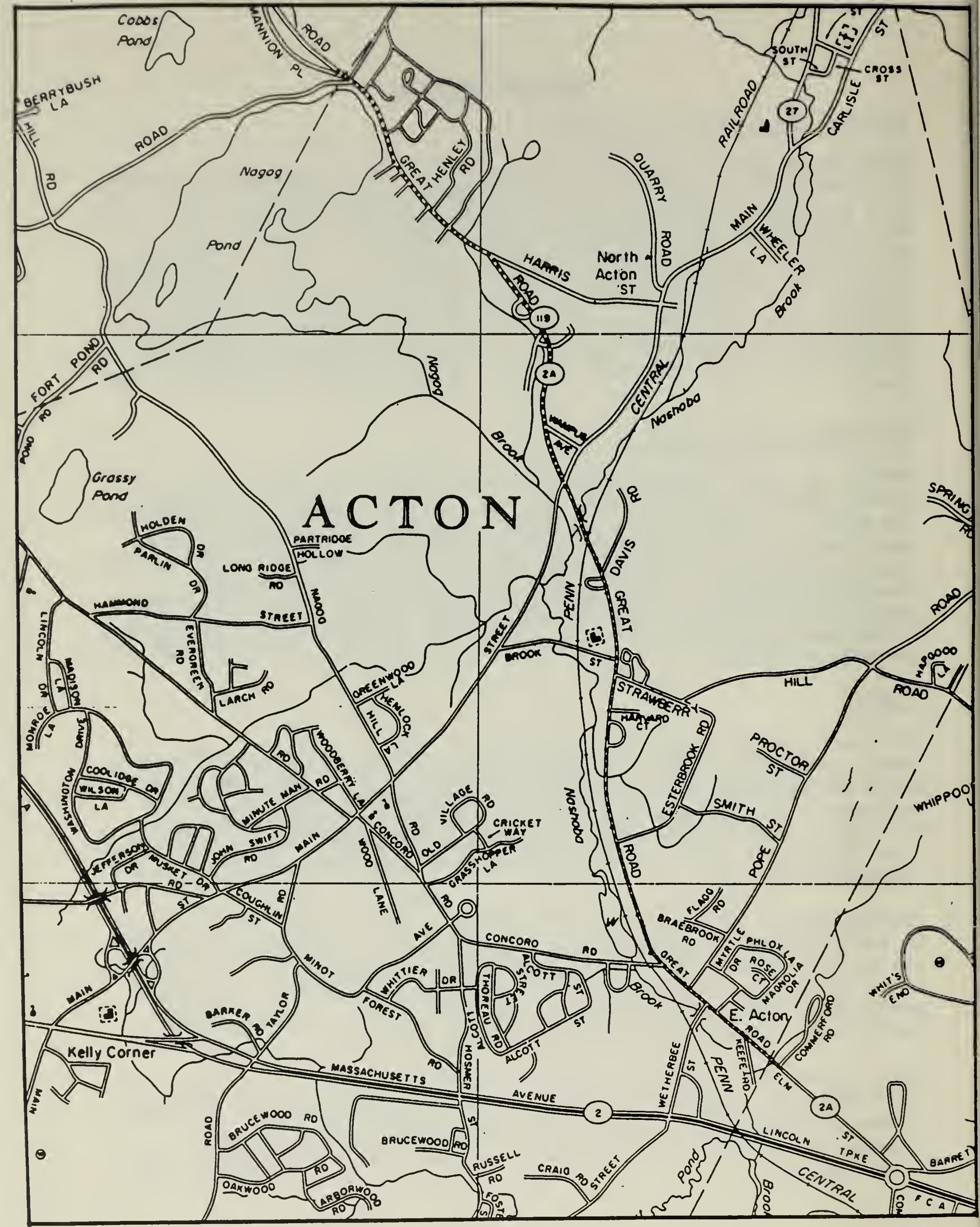

Figure 1

ROUTE 2A IN ACTON

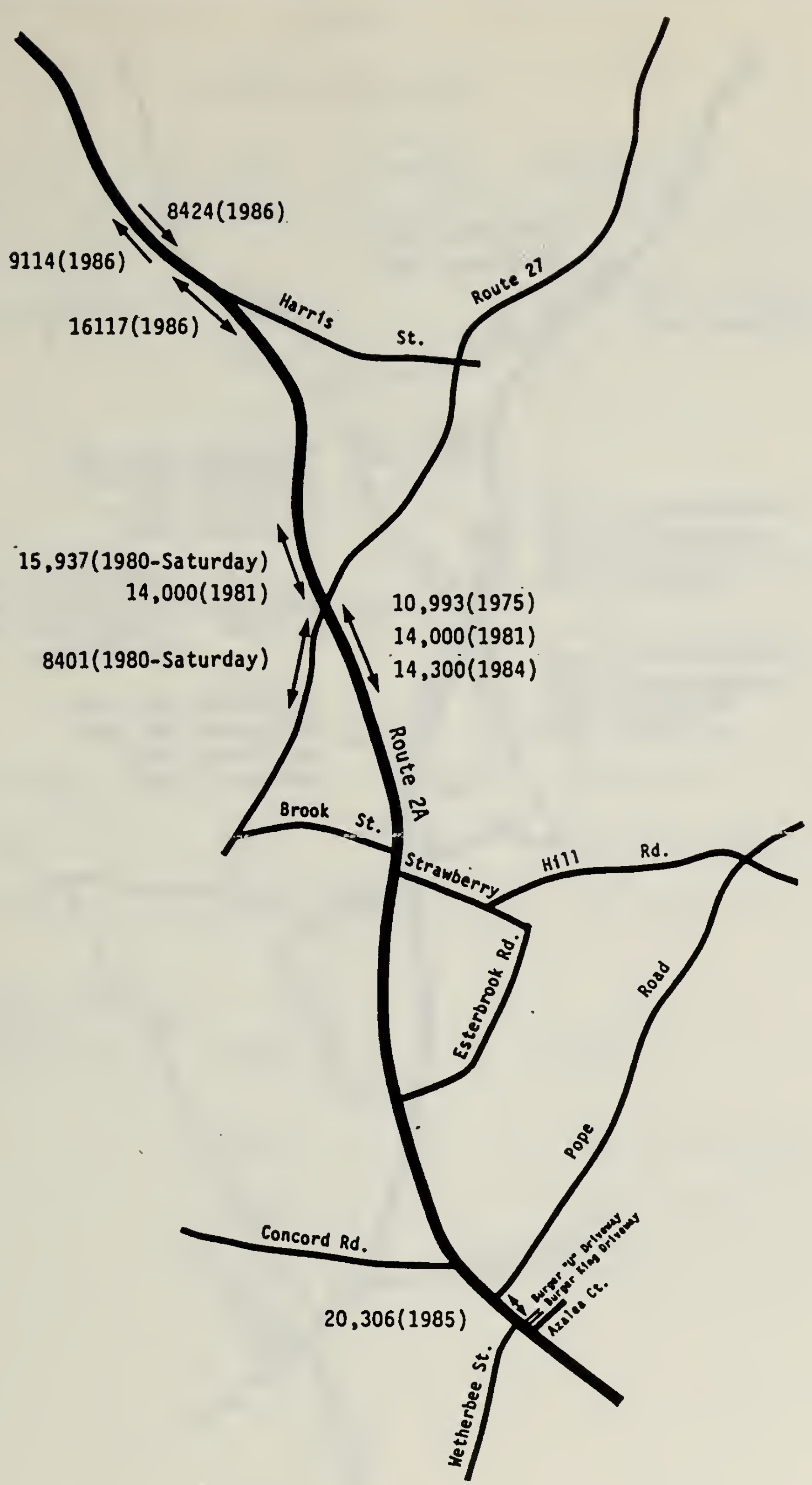

Figure 2

AVERAGE DAILY TRAFFIC

ACTON

Sources are listed in the Appendix.

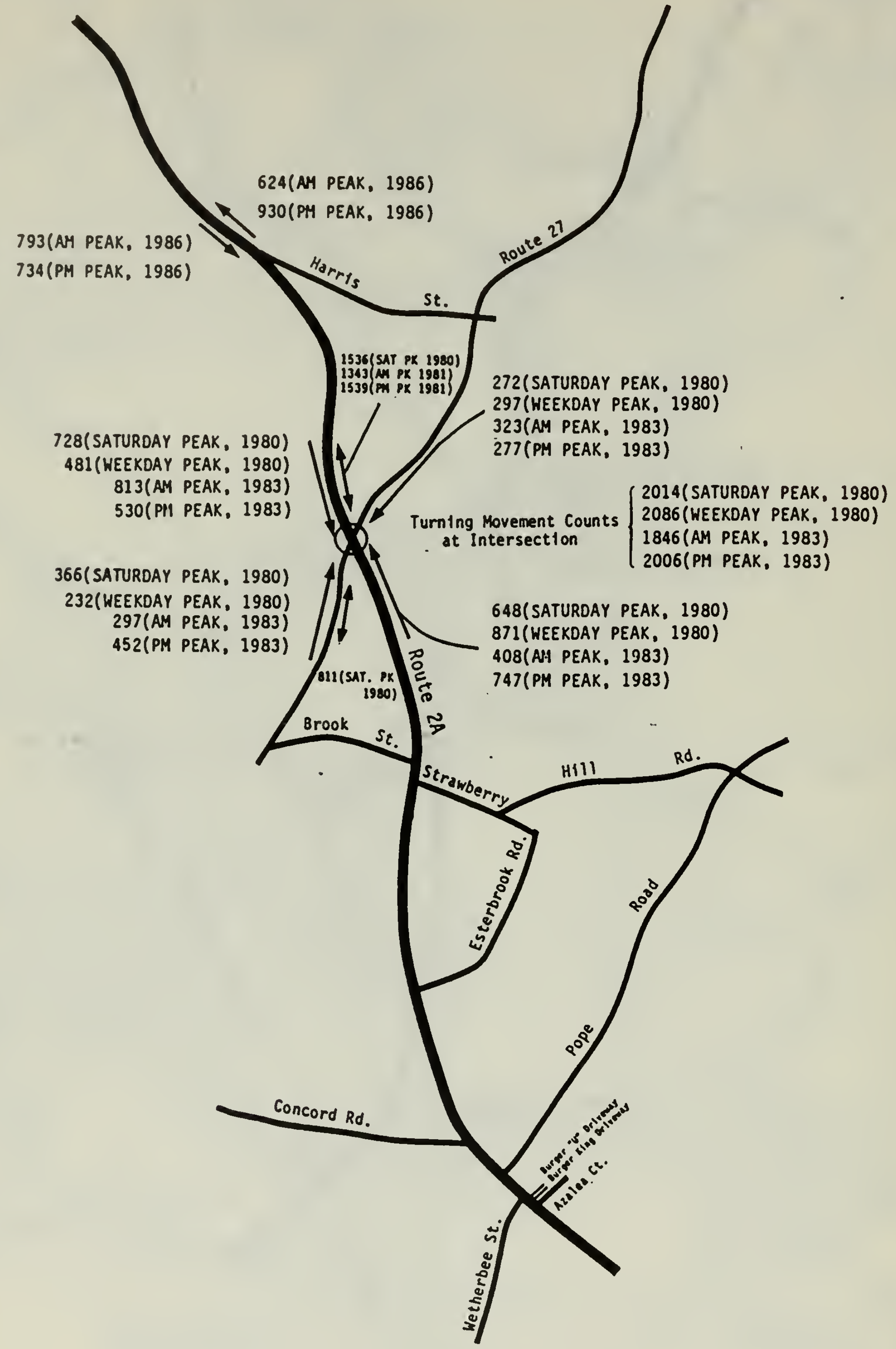

Figure 3

PEAK HOUR VOLUMES
ACTON

Sources are listed in the Appendix.

Table 1

## Levels of Service

| Location | Year | Level of Service | Movement |
|---|---|---|---|
| Route 2A@ | | | |
| Route 27 (signalized) | 1980 | C | all |
| " " | 1982 | C | all |
| " " | 1983 | E | all |
| " " | 1985 | D-E | all |
| Wetherbee St. | 1985 | A-B | left onto Wetherbee St. |
| " " | 1985 | B-C | right on Rte. 2A |
| " " | 1985 | E | left onto Rte. 2A |
| Burger King Driveway | 1985 | A | left onto B.K. driveway |
| " " " | 1985 | A-B | right onto Route 2A |
| " " " | 1985 | E | left on Rte. 2A |
| Prior to Burger King Driveway (before construction of B.K.) | 1980 | C | both |
| Azalea Ct. | 1985 | A | left onto Azalea Ct. |
| " " | 1985 | A | right onto Rte. 2A |
| " " | 1985 | E | left onto Rte. 2A |

## Safety

By reviewing Route 2A accident information from previous studies, the following pertinent data has resulted. According to the 1980 Alan M. Voorhees and Associates' Addendum to the 1979 Traffic Study for a proposed retail complex at the Route 2A, Route 27 intersection, there were twenty-nine reported accidents from 1977 to 1979, six of which occurred during A.M., and P.M. peak commuter periods. The Traffic Impact and Access Study of the Proposed R & D Development (Technology Park), to be located on Route 27 in Acton, by Vansasse/Hangen Associates, Inc. 1983, states that from January 1980 to December 1981, seventeen accidents occurred at this same intersection.

The section of Route 2A near Wetherbee Street was also studied. Segal DiSarcina Associates' 1985 Traffic Impact Analysis of the D'Angelo's Restaurant Site, showed that from the beginning of 1983 to mid 1985, there were fourteen accidents in this area, compared to the town total of 1435 for the same period. Most of the accidents involved turning movements.

## Problems Identified by Others

In previous studies of traffic and new developments along Route 2A, two problems were identified.

First, the Traffic Impact Analysis of the D'Angelo's Restaurant Site, by Segal DiSarcina Associates in 1985, showed the difficulty in making left turns onto Route 2A from all driveways and intersecting streets in the vicinity of Wetherbee Street. Delays of 9 to 17 seconds are the norm during the peak hours due to the heavy traffic volumes on 2A.

The second traffic problem concerns the intersection at Route 27. According to the Traffic Impact Study for Technology Park, also by Segal DiSarcina Associates in 1985, the left turn traffic tends to back up while waiting for gaps in the opposing traffic stream, resulting in the impedance of straight through traffic. The pavement widths of the approach lanes to the intersection are too narrow to allow for adequate left turn storage. The recommendation by Segal DiSarcina Associates, was the addition of four to six feet pavement on intersection approaches to allow for more efficient operations.

## FUTURE DEVELOPMENT

Almost the entire Route 2A corridor is zoned for general business activity. If all the land in the corridor which does not lie below the level of the flood plain were to be developed to the fullest amount allowed by the zoning code, the result would be an intensity of activity far in excess of the road system's carrying capacity. Table II shows the amount of traffic which might potentially be generated under those conditions, using estimates of developable acreage and standard trip generation rates.

It should be emphasized that this is an estimate of the absolute maximum for new traffic under current zoning. It is based on an assumption that every square foot of allowable floor space along the entire corridor will be built, a condition that has not occurred even along the most built-up sections of Route 9.

A more realistic estimate may be based on trip rates by land area rather than floor space. Table III shows figures based on per-acre rates.

As Table III shows, the category of general business allows a variety of uses with very different trip generation characteristics. The mix of office and retail development which takes place will greatly affect the traffic levels on Route 2A. This point will come up again in the discussion of zoning measures.

Comparing potential new traffic to current traffic volumes, it is clear that full development, under any of these scenarios, would result in a many-fold increase in traffic volumes along Route 2A. Assume for the sake of discussion that 85% of the traffic on Route 2A now is locally generated and the other 15% thru traffic which will grow at a constant rate of 2% per year. That would mean that in ten years, the daily level of non-locally generated travel would be around 3000, and the level at the P.M. peak hour would be around 300. Suppose that, by that time, the Route 2A corridor were fully developed in the sense that every lot contained a facility which, on a per-acre basis, would generate traffic equivalent to that for properties of the same size and type. By adding the figures representing thru traffic to those for a 50-50 mix of office and retail use from Table III, one can derive estimates for daily and P.M. peak hour volumes of 91,300 and 8,100, respectively. These figures represent an increase over the present situation of more than five-fold. The rule of thumb for the two-way capacity of a two-lane, two-way road is 2000 vehicles per hour. It is clear, then, that if development along Route 2A continues unabated until the corridor is entirely filled, the nature of the road would be transformed. Widening, channelization and signalization at many points would probably be necessary.

There is, of course, no way of knowing when, or if, a state of 'full build-out' will be attained. The rate, and to some extent the type, of development is a function of the general health of the economy as well as such locally specific factors as housing trends, employment opportunities and competition from retail activities in nearby towns. Growth tends to be cyclical; development may well level out for a period of years before picking up again. However, in the analysis above, the horizon date is less important than the traffic conditions that will exist when the Route 2A corridor is fully developed, whenever that may occur.

### Table II

### Maximum Potential Traffic Impacts of Full Development (Rte. 2A Corridor Under Present Zoning)

| Zoning: | Business | Industrial | Total |
|---|---|---|---|
| Approximate Land Area (acres): | 270 | 100 | 370 |
| Allowable Intensity (sq.ft./acre): | 45,750 | 45,750 | --- |
| Potential Floor Space (sq.ft.*): | 12.3 mil | 4.6 mil | --- |
| Weekday Trip Generation (trip ends per Ksf**): | 49.64 | 6.98 | --- |
| Potential New Weekday Traffic (trip ends): | 613,000 | 32,000 | 645,000 |

* Based on 35% lot coverage, 3 story max. (Acton Zoning bylaw, May 7, 1984)

** Source: "Development and Application of Trip Generation Rates", U.S. Department of Transportation, 1985.

Note: Ksf refers to thousands of square feet.

### Table III

### Potential Impacts of Full Development Using Trips per Acre Rates

| Zoning | Land Area | Allowable Use | Weekday Trip Generation (trips per acre) | Potential Weekday Trips | | |
|---|---|---|---|---|---|---|
| | | | | Daily | Morning peak hour | After-noon peak hour |
| General Business | 270 | Shopping Center | 462 | 125,000 | 3,200 | 13,800 |
| | | Offices | 299 | 80,700 | 7,000 | 7,000 |
| | | 50-50 mix | 381 | 103,000 | 5,100 | 10,400 |
| Industrial | 100 | Light Industry | 76 | 7,600 | 900 | 800 |
| Total | 370 | | | 88,300 to 132,600 | 4,100 to 7,900 | 7,800 to 14,600 |

While the ultimate result in land use along Route 2A cannot be predicted, it is possible to look a short way ahead by calculating the trip-generation characteristics of facilities currently on the drawing board. Table IV shows known pending developments along Route 2A. As the totals show, projects "in the pipeline" right now have the potential to increase the traffic along Route 2A by more than 50% over present amounts. These developments will be built within the next two or three years. The developers of Acorn Park have a 5-10 year building program whose final result will be a 536,000-square-foot complex. If it is realized, Acorn Park alone will generate approximately of 5900 trips daily, more than one third of the total volume now on Route 2A.

# TOWN OF ACTON

## KNOWN PENDING COMMERCIAL/INDUSTRIAL DEVELOPMENT

(FEBRUARY 13, 1986)

### APPROVED - NOT YET BUILT/OCCUPIED

| | | | Land Use | Rates | | | Trips | | |
|---|---|---|---|---|---|---|---|---|---|
| Street | Name - Type of Development | Square Feet | Code* | Daily | A.M. | P.M. | Daily | A.M. | P.M. |
| Route 2A | D'Angelo's-60 Seat Restaurant | 2,500 | 833 | 685.61 | 15.00 | 41.12 | 1,710 | 38 | 103 |
| Railroad St. | Authentic Homes-Mini-Warehouse | 7,200 | 150 | 4.88 | .66 | 1.63 | 35 | 5 | 12 |
| Route 2A | Circle Furniture-Retail Add'n. | 7,400 | 820 | 83.43 | 2.83 | 9.97 | 617 | 21 | 74 |
| 45 Nagog Pk. | Setra Systems-Industrial Add'n. | 26,000 | 110 | 6.98 | .95 | .88 | 181 | 25 | 23 |
| Route 2A | Heritage Square-Retail Cluster | 12,000 | 820 | 83.43 | 2.83 | 9.97 | 1,000 | 34 | 120 |
| Route 2A | 125 Nagog Park-Office & Industrial | 73,300 | 710/110 | 12.43/6.98 | 1.98/.95 | 1.93/.88 | 711 | 107 | 103 |
| Route 2A | 3 Pines Realty-Office & Retail | 6,200 | 710/820 | 12.43/83.43 | 1.98/2.83 | 1.93/9.97 | 297 | 15 | 37 |
| Route 2A & 27 | Prendergast-Retail Center | 43,800 | 820 | 83.43 | 2.83 | 9.97 | 3,650 | 124 | 437 |
| Route 2A | Deck House-Warehouse Add'n. | 26,000 | 150 | 4.88 | .66 | 1.63 | 127 | 17 | 42 |
| | | 476,500 | | | | | | | |

### PRELIMINARY TECHNICAL REVIEW - STAFF LEVEL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Acton Research Corp.-Indus. Devel. | 4,300 | 110 | 6.98 | .95 | .88 | 30 | 4 | 4 |
| Route 27 | Acton Foreign Auto-Auto Repair | 9,700 | | | | | | | |
| Route 2A | R. Smith-502 Great Rd.-Offices | 10,000 | 710 | 12.43 | 1.98 | 1.93 | 124 | 20 | 19 |
| Route 2A | R. Smith-502 Great Rd.-Office Cnvrsn. | 3,500 | 710 | 12.43 | 1.98 | 1.93 | 44 | 7 | 7 |
| Route 2A | Gallant & Brock-Office Add'n. | 7,800 | 710 | 12.43 | 1.98 | 1.93 | 97 | 15 | 15 |
| | Authentic Homes-Day Care | 6,000 | | | | | | | |
| Route 2A | U.S. Post Office-New Building | 8,000 | | | | | | | |
| Route 2A | Acorn Park | 50,000 | 710/110 | 12.43/6.98 | 1.98/.95 | 1.93/.88 | 553 | 86 | 85 |
| | | 176,500 | | | | | 9,176 | 518 | 1,081 |

Total Known Pending = 752,000 sq. ft.

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* From Trip Generation (Institute of Transportation Engineers, 1985)

Source: Building Inspection Department, Spring 1986.

## GROWTH MANAGEMENT MEASURES

The preceding analysis has shown the potential for unmanageable amounts of new traffic along Route 2A due to business construction and other development. The retail, office and industrial projects now in the pipeline will result in a significant increase in traffic levels; it is appropriate to consider, at this point, limiting future growth in some way. This section describes several strategies for growth management.

### Downzoning

The most direct method of capping development in the corridor is to remove remaining undeveloped or lightly developed land from consideration for future development by changing its zoning so as to exclude high concentrations of traffic generating activity. For example, suppose a lot is rezoned from 'general business' to 'light industrial', thus disallowing retail uses. Where previously a shopping center would have been permitted, which would have generated 50-80 trips per thousand square feet per day, now the site would be the destination primarily for employees rather than shoppers and would generate on the order of 6-10 trips per thousand square feet per day. The timing of the traffic would also be different: peaks would come around 9:00 A.M. and 5:00 P.M., and weekend traffic would be negligible (while retail uses draw their biggest crowds on Saturday). The difference between the peaking characteristics of work- and shopping-related traffic suggests that the town might profit by zoning the corridor so as to encourage a mix of retail and industrial uses. Not only would the congestion caused by shoppers be tempered by the relatively light industrial traffic, but the employees of those industrial concerns would likely shop at the stores along Route 2A.

### Planned Unit Developments (PUDs)

One way to incorporate the concept of mixed uses into the zoning bylaw is through a planned or mixed use unit development provision. Planned unit developments (PUDs) are a zoning device which permits flexibility in the distribution of development, without abandoning the basic regulation of total intensity of land use which zoning affords. Relatively intense development surrounded by open space is often more desirable than uniform densities, both from the point of view of the community, which saves on infrastructure investment, and from the point of view of the resident or property owner, who benefits from a more efficient, urbane and well-designed environment and from the amenity of open space. For this reason, PUDs have emerged as a popular tool for development control.

PUDs can also be used to provide developers a mechanism for mixing uses which zoning regulations otherwise would keep separate. PUDs are specifically permitted by G.L. ch. 40A, s. 9, which defines them as mixed-use development on a plot of land containing at least the lesser of 60,000 square feet or five times the minimum lot size of the zoning district. PUDs may contain residential, open space, commercial industrial or other uses, and a variety of building types are permitted by special permit.

PUDs do not function to control the amount of growth or to direct its location, except within a relatively small area. They can be useful tools, however, in the amelioration of design and in minimizing the impact of new development on existing traffic and utilities. A PUD which incorporated residential and commercial uses on a single site could work to reduce the travel needs of its occupants if the retail opportunities it contained were suited to their everyday needs. This is an important "if", because mixing residences with commercial activity geared for a regional market - boutiques and sporting goods stores, for instance, as opposed to dry cleaners and drug stores - will serve no traffic-mitigation purpose. The PUD provision can prescribe that the type of retail activity be declared in the site plan submitted for the planning board's approval.

## Transfer of Development Rights (TDR)

Another type of flexible zoning technique, which has been tried with some success in Massachusetts, is transfer of development rights (TDR). The principle of TDR rests on the idea that ownership of land actually consists of a "bundle of rights" with regard to that land. Most TDR programs begin with the designation of two different types of zones (not related to the zones used in land use zoning): "preservation" or "sending" zones, which comprise the areas in which development is to be limited; and "transfer" or "receiving" zones, which are those areas into which growth is to be channeled. In the sending zones, development rights are assigned to property which will be available for purchase and transfer to the receiving zones, but not for use within the sending zones. These development rights are valuable within the receiving zones because they empower the holder to develop his or her land more intensely than the zoning would otherwise allow. Thus landowners in sensitive areas are limited in their ability to develop their land; but they are compensated for their loss with rights which are valuable to developers in other, less sensitive areas.

In Massachusetts, TDR has been implemented in at least two communities, Bedford and Concord. As part of their Planned Residential Development (PRD) ordinances, those towns specify that "the density of the PRD tract may be increased by conveying to the town, or restricting for the benefit of the town, land which is not within the PRD tract." In this instance, the TDR approach is not mandatory or tied to a reduction in use of a certain parcel. It is an optional approach under which landowners may choose to restrict development of land in one area (generally land which is difficult to develop) in favor of development bonuses on other land.

The allocation of development rights raises the spectre of uncompensated taking if a parcel is given rights whose value is far below that of the land if it were developed to its full market potential. The appropriateness of the number and value of the development rights awarded depends upon the skill and the integrity with which the TDR program is designed and administered. In any case, the passage of a TDR ordinance or bylaw may be followed by a period of litigation as property owners adjust to, and contest, the community's estimation of the development value of their land.

There are also questions about how, and if, transactions in development rights would be taxed; whether the imposition of restrictions constitutes a "taking" requiring compensation; how foreclosure on development rights would be handled; how liens against development rights would be recorded; and how development rights differ from easements.

A question arises as to the costs of development rights transfer. If a market in development rights develops which accurately communicates the values of those rights, there is no cost to developers, purchasers or the community as a whole, because developers receive and purchasers pay exactly what the development rights are worth. It is possible that the owners of property adjacent to the receiving zone will pay because they must endure larger structures than would otherwise be permitted within their zoning district, and because their property may be devalued accordingly. On the other hand adjacent owners may benefit from the larger building and activities depending on the circumstances. In addition to this cost, there is the cost of administering the TDR program.

TDR can be a valuable means of preserving open space, historical properties, and ecologically fragile land without subjecting their owners to "wipeouts". It can also channel growth, away from prime agricultural land and open space and overdeveloped areas, and toward areas with sufficient infrastructure.

One drawback of TDR is that it is new; development rights are a new type of property whose value is difficult to perceive. Commentators on TDR mention the likelihood that a fluid market in development rights may be hard to create, given that there is not at present any marketplace, such as there is, for example, in real estate itself.

The difficulty of accurately and equitably assigning development rights has already been discussed. There is no single yardstick for the valuation of development rights. Rights cannot be assigned proportionally to acreage owned, because the land within a sending zone will always vary in value according to locational and other characteristics. A plan for creating TDR in South Kingston, Rhode Island resorted to assessing the difference between market value and use value in each parcel. While this is an equitable solution, it presents considerable difficulties in assessing actual and potential property values.

## Impact Fees

Developer exactions or impact fees provide for payment or work by the developer to compensate the community for part of the added cost incurred as a result of new development. This is important in Massachusetts, where Proposition 2 1/2 generally does not allow such added costs to be met directly by increased taxes on such developments. Because impact fees are a new tool, they involve legal, technical, and attitudinal obstacles which in this Commonwealth are greater than in many "younger", more flexible and adaptable states. (In California, Colorado, Florida, Montana, Nevada, New York, Maryland, Utah, and Wisconsin impact fees or fees in lieu of land dedication have been upheld by courts or have been expressly authorized by statute.)

While developers are frequently asked to contribute off-site improvements in Massachusetts, there are no standards, uniformity, or accepted rationale for the exactions; and the requests may range from a reasonable and truly voluntary contribution to an excessive and unjustified, illegal demand.

It is important that exactions be imposed equitably on all developers, and that they be proportional to the impacts which developments will have on the community.

In general, impact fees should be applied to the capital costs of expanded facilities, operating, maintenance, and replacement costs, should be funded by the current tax levy.

When challenged in court, developer exactions have been subjected to certain tests. The fees imposed must have a rational and direct connection, or "nexus" as the lawyers call it, to the particular development. It is necessary to be able to show that the fees will be used to benefit the development and not the community generally. The level of fees must not exceed the added costs imposed by the particular development and must not include operating or maintenance costs or any cost paid out of another source or imposed on all residents, including the residents of the new development. There should be a provision for a variance or an appeal, where due to specific circumstances the regular fees would not be equitable. Finally, unless they can be passed on to state or federal government, fees ought to be waived for developments for low or moderate income people.

In Massachusetts, as in most states except California, cities and towns can only impose taxes as expressly authorized by the legislature, while fees (either user fees or regulatory fees) may be imposed by communities. It is, therefore, important to define the charges imposed on the developer to pay for the added costs caused by development in a way that courts will classify as fees. This means, for instance, that they should be based on the benefit to the occupants of the new development and not on the value or size of the development.

It is generally accepted that the developer must provide or pay for improvements within the development. In many states, but not in Massachusetts, this includes the dedication land within the development for parks, and in some cases for other purposes, or the payment of fee in lieu of such dedication. From there, several levels of developer exactions may be visualized, either imposed as specific conditions of a special permit in a particular case or applying uniformly to all developments of certain size or type under a bylaw that should include:

- filing fee for engineering review;
- the cost of special studies (e.g., traffic);
- extending (connecting) roads for some distance outside the development;
- enlarging or improving transportation facilities or utilities a considerable distance outside the development.

The developer may do the work, pay somebody else to do it, or pay its proportionate share of the cost of a facility intended to meet the increased demand due to several new developments over time. If a developer contributes its share of the cost, it is essential that the money be held separately for its intended use, such as by setting up an assessment district or an escrow account, and not be co-mingled with money for other purposes, even if it is for the same development. If money is left over after the cost of the expanded facility has been met, it may have to be refunded. Since costs change over time, some jurisdictions recalculate the fees annually, based on the theoretical current replacement cost of the new or expanded facility.

The fees must be based on reasonable planning and construction standards which, ideally, should be defined in the master plan. In any event the fee schedule needs to be substantiated and consistent for all developments. Residential, commercial, industrial, and institutional fees may be based on different criteria (households, residents, floor area, acres, trips generated). If called upon, the town should be able to substantiate the costs of meeting the established performance standards and the developer's share of the cost of needed facilities. This requires a sophisticated and thorough process, using well-qualified professionals, detailed records and accounts. See the Appendix for a sample development impact standard from Framingham's zoning code.

Because of the relatively large number of independent projects that take place along Route 2A, the application of developer exactions there would require a very well-drafted bylaw. All of the issues raised above of equity, attribution of impacts to specific projects, and relevance of exaction to impact are critical in apportioning responsibility for improvements fairly among developers. If these problems can be solved, however, developer exactions can be a valuable element of the town's growth management strategy. As development continues and traffic impacts accrue, needed improvements to Route 2A could be made, even if MDPW funds were not immediately available.

## TRANSPORTATION SYSTEMS MANAGEMENT

Given a certain level of physical development in an area, the only way to influence the present amount of traffic is to change the characteristics of travel to and from those buildings. For example, if the people who work at an office building were to share rides, fewer cars would be driven and the same number of person-trips would result in fewer vehicle trips.

### Paratransit

Studies have shown that of all the available measures which might diminish the amount of automobile traffic - including increased gas taxes, improved mass transit, education programs, bicycle facilities, etc. - ridesharing has by far the greatest potential. Since the typical vehicle occupancy rate is about 1.25 persons per vehicle, it is obvious that most cars on the road are not carrying nearly as many people as they could; indeed most carry only the driver.

The problem for planners is twofold: first to identify those people who could be riding together, and second to convince them to do it. A town cannot do either of these things alone, but should enlist the help and cooperation of two other groups: local employers and Caravan, the state-sponsored commuter transportation management service.

The standard method of initiating a rideshare promotion is to identify and match prospective commuting partners. The method involves surveying commuters, sorting commuters by home and work location and hours of work, and then often supplying them with 'matchlists.' The work site is the logical place to locate a rideshare program, since workers are a captive audience and have a common destination.

A good deal of informal ridesharing takes place among co-workers. Some employers also provide bulletin boards for the exchange of messages. The most effective approach, however, is to establish a formal program for promotion and facilitation of ridesharing. Here is where Caravan comes in. All of Caravan's services are provided on a non-profit basis. Caravan will match commuters for ridesharing, either using Caravan listings of individual clients or by helping employers set up their own in-house computerized rideshare programs using micro-computer software. Caravan will also perform on-site promotional services aimed at overcoming commuters' resistance to ridesharing. Finally, Caravan provides a full range of vanpool support services, including van leasing, driver training, maintenance and accounting.

Acton can benefit from helping Caravan publicize its services among employers in all parts of the town, but if an effort were made to publicize and promote the benefits of ridesharing in the Route 2A corridor in particular, employees there might be induced to form a consortium of Caravan participants. The town could play an instrumental role in inducing established employers to contact Caravan; the production of a plan for attaining a certain level of vehicle occupancy among employees could even be a requirement for site plan approval. This ridesharing strategy could be made part of an overall access plan requirement.

## Traffic Engineering

On a two-lane road having unlimited access and serving land zoned for business use, problems of 'friction' from numerous driveways will compound the congestion caused by the volume of traffic alone. As buildings proliferate, the driveways begin to impinge not only on the smooth flow of traffic on the roadway but on each other. Conflict points can increase to the point where conditions approach the chaotic.

To prevent such a situation, it is often necessary to install physical traffic management accessories such as medians and islands. The function of such devices is to limit the number of conflict points by preventing certain types of maneuvers and to consolidate streams of traffic by channeling vehicles through specified openings. Adding turn lanes, either at the center or the outside of the roadway serves deceleration requirements and removes turning vehicles from thru lanes.

Table V, from the Federal Highway Administration manual Access Management for Streets and Highways, (June 1982) shows a comprehensive variety of access management techniques. A voluminous appendix of the manual details the design of each and describes the conditions which would warrant the technique.

TABLE V Access Management Techniques

## CATEGORY A

### LIMIT NUMBER OF CONFLICT POINTS

A.1: Install median barrier with no direct left-turn access
A-2: Install raised median divider with left-turn deceleration lanes
A-3: Install one-way operations on the highway
A-4: Install traffic signal at high-volume driveways
A-5: Channelize median openings to prevent left-turn ingress and/or egress maneuvers
A-6: Widen right through lane to limit right-turn encroachment onto the adjacent lane to the left
A-7: Install channelizing islands to prevent left-turn deceleration lane vehicles from returning to the through lanes
A-8: Install physical barrier to prevent uncontrolled access along property frontages
A-9: Install medial channelization to control the merge of left-turn egress vehicles
A-10: Offset opposing driveways
A-11: Locate driveway opposite a three-leg intersection or driveway and install traffic signals where warranted
A-12: Install two one-way driveways in lieu of one two-way driveway
A-13: Install two two-way driveways with limited turns in lieu of one standard two-way driveway
A-14: Install two one-way driveways in lieu of two two-way driveways
A-15: Install two two-way driveways with limited turns in lieu of two standard two-way driveways
A-16: Install driveway channelizing island to prevent left-turn maneuvers
A-17: Install driveway channelizing island to prevent driveway encroachment conflicts
A-18: Install channelizing island to prevent right-turn deceleration lane vehicles from returning to the through lanes
A-19: Install channelizing island to control the merge area of right-turn egress vehicles
A-20: Regulate the maximum width of driveways

## CATEGORY B

### SEPARATE BASIC CONFLICT AREAS

B-1: Regulate minimum spacing of driveways
B-2: Regulate minimum corner clearance
B-3: Regulate minimum property clearance
B-4: Optimize driveway spacing in the permit authorization stage
B-5: Regulate maximum number of driveways per property frontage
B-6: Consolidate access for adjacent properties
B-7: Require highway damages for extra driveways
B-8: Buy abutting properties
B-9: Deny access to small frontage
B-10: Consolidate existing access whenever separate parcels are assembled under one purpose, plan, entity, or usage
B-11: Designate the number of driveways regardless of future subdivision of that property
B-12: Require access on collector street (when available) in lieu of additional driveway on highway

## CATEGORY C

### LIMIT DECELERATION REQUIREMENTS

C-1: Install traffic signals to slow highway speeds and meter traffic for larger gaps
C-2: Restrict parking on the roadway next to driveways to increase driveway turning speeds
C-3: Install visual cues of the driveway
C-4: Improve driveway sight distance
C-5: Regulate minimum sight distance
C-6: Optimize sight distance in the permit authorization stage
C-7: Increase the effective approach width of the driveway (horizontal geometrics)
C-8: Improve the vertical geometrics of the driveway
C-9: Require driveway paving
C-10: Regulate driveway construction (performance bond) and maintenance
C-11: Install right-turn acceleration lane
C-12: Install channelizing islands to prevent driveway vehicles from backing onto the highway
C-13: Install channelizing islands to move ingress merge point laterally away from the highway
C-14: Move sidewalk-driveway crossing laterally away from highway

## CATEGORY D

### REMOVE TURNING VEHICLES FROM THE THROUGH LANES

D-1: Install two-way left-turn lane
D-2: Install continuous left-turn lane
D-3: Install alternating left-turn lane
D-4: Install isolated median and deceleration lane to shadow and store left-turning vehicles
D-5: Install left-turn deceleration lane in lieu of right-angle crossover
D-6: Install medial storage for left-turn egress vehicles
D-7: Increase storage capacity of existing left-turn deceleration lane
D-8: Increase the turning speed of right-angle median crossovers by increasing the effective approach width
D-9: Install continuous right-turn lane
D-10: Construct a local service road
D-11: Construct a bypass road
D-12: Reroute through traffic
D-13: Install supplementary one-way right-turn driveways to divided highway (noncapacity warrant)
D-14: Install supplementary access on collector street when available (noncapacity warrant)
D-15: Install additional driveway when total driveway demand exceeds capacity
D-16: Install right-turn deceleration lane
D-17: Install additional exit lane on driveway
D-18: Encourage connections between adjacent properties (even when each has highway access)
D-19: Require two-way driveway operation where internal circulation is not available
D-20: Require adequate internal design and circulation plan

Source: Federal Highway Administration, Access Management for Streets and Highways (June 1982)

## RECOMMENDATION

It is recommended that the town set up a system of project review which will establish responsibility for traffic generation. Access plans should be incorporated into site plans for the purpose of review.

An access plan would generally include three elements: traffic impact analysis, access design, and a traffic mitigation program. A traffic impact analysis basically describes the impact a development will have on roadway capacity. The access design element details how a proposed project will interact with the surrounding road network. The traffic mitigation program describes what the developer will do to reduce or minimize site related traffic.

### Traffic Impact Analysis

The traffic impact analysis is basically what is required now of developers. It includes:

- A summary of existing conditions within a prescribed area near the site, with directional traffic volumes and turning movement counts;
- An estimate of the amount of traffic the proposed development would be expected to generate;
- Trip distribution analysis showing the paths of trips destined for the site;
- projections, based on the above and on estimated background traffic growth, of future traffic in the project area.
- an operational and capacity analysis of both present and projected traffic with recommendations for improvements.

### Access Design

The access design element should entail how the proposed project will interact with the surrounding traffic network. Driveway dimensions, as well as the location of neighboring drives, should be shown. When reviewing access design, the planning board should be alert to the opportunity to create shared driveways between adjoining lots.

Interior circulation is important insofar as a poor design may result in queues of vehicles extending out into the roadway. Sufficient interior stacking space, and a logical flow which will not become jammed, should be required.

## Traffic Mitigation

The traffic mitigation program is the area in which the town can do the most to influence the actual trip generation characteristics of the project. Developers should be required to consider mass transit and ridesharing options to reduce the number of vehicle trips to and from the development. The town should seek commitments from develpoers to bring about ridesharing and employee travel during off-peak rather than peak hours. Measures the town can encourage include:

- preferential parking for carpools and vanpools;
- participation in Caravan programs or other forms of rideshare promotion;
- bicycle and pedestrian facilities;
- flex-time;
- shuttle buses (particularly between residential and shopping areas);
- contributions toward off-site traffic engineering improvements.

## APPENDIX

### Zoning Bylaw Provisions for Site Plan Review*

IV.I.6. Development Impact Standards

The following standards shall be used in evaluating projected impacts of proposed developments. "Required" standards must be met by all developments subject to this section. "Recommended" standards are set forth as guidelines to both the Planning Board and applicants, and are not intended to be inflexible requirements nor to discourage creativity and innovation.

(a) Traffic Impact Standards

(1) Required:

The "level of service" (LOS) of all impacted intersections and streets shall be adequate following project development, or the total value of off-site traffic improvements required or approved by the Planning Board as a condition of approval shall be equal to three per cent (3%) of the total development cost of the proposed project. For purposes of this standard:

(i) "level of service" (LOS) shall be determined according to criteria set forth by the Transportation Research Board of the National Research Council;

(ii) "impacted" means located within 1000 feet of the closest boundary of the project site and projected to receive at least five per cent (5%) of the anticipated average daily peak hour traffic generated by the proposed development;

(iii) "adequate" shall mean a level of service of "B" or better for rural, scenic and residential streets and for all new streets and intersections to be created in connection with the project; and "D" or better for all other streets and intersections; and

(iv) "total development cost" shall mean the total of the cost or value of land and all development-related improvements, and shall be determined on the basis of standard building or construction costs, such as published in the Engineering News Record or other source acceptable to the Planning Board, for the relevant type of structure and use.

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* Source: Town of Framingham Site Plan Review (Adopted by Special Town Meeting - June 19, 1985)

(2) Recommended:

The proposed site plan shall minimize points of traffic conflict, both pedestrian and vehicular. The following guidelines shall be used to achieve this standard:

(i) Entrance and exit driveways shall be so located and designed as to achieve maximum practicable distance from existing and proposed access connections from adjacent properties.

(ii) Where possible, driveways shall be located opposite similar driveways.

(iii) Sharing of access driveways by adjoining properties and uses is encouraged.

(iv) Left-hand turns and other turning movements shall be minimized.

(v) Driveways shall be so located and designed as to discourage the routing of vehicular traffic to and through residential streets.

(vi) Pedestrian and bicycle circulation shall be separated from motor vehicle circulation as far as practicable.

IV.I.8. Conditions, Limitations and Safeguards

In granting approval of an application the planning Board may impose conditions, limitations and safeguards which shall be in writing and shall be a part of such approval. Such conditions may include, among other matters and subjects:

(a) Controls on the location and type of access to the site;

(b) Controls on the number of vehicles that arrive or depart during the morning and/or evening peak hours (including controls on the maximum number of vehicles which may use the off-street parking areas during said periods);

(c) Requirements for off-site improvements to improve the capacity and safety of roads, intersections, pedestrian ways, water, sewer, drainage, and other public facilities which are likely to be affected by the proposed development;

(d) Requirements for donation and/or dedication of land for right-of-way to provide for future roadway and/or intersection widenings or improvements;

(e) Requirements for securing the performance of all proposed work, including proposed off-site improvements, by either or both of the following methods: (1) a performance bond, a deposit of money, negotiable securities, letter of credit, or bank passbook in an amount determined by the Planning Board to be sufficient to cover the cost of all or any part of the improvements required as conditions of approval; (2) a covenant running with the land, executed and duly recorded by the owner of record, whereby the required improvements shall be completed before the property may be conveyed by other than a mortgage deed.

(f) Conditions to minimize off-site impacts on traffic and environmental quality during construction.

## SOURCES

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